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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/765,808

01/27/2004

Huang-Ming Chen

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EXAMINER

DUANE MORRIS LLP

IP DEPARTMENT (TSMC)

30 SOUTH 17TH STREET

PHILADELPHIA, PA 19103-4196

ART UNIT

PAPER NUMBER

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/765,808

Applicant(s)

CHEN ET AL.

Examiner

Karla Moore

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 October 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 and 29-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 29-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 August 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary.

Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary.

Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-2, 4-7 and 29-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent No. 2002009042 A to Kimura in view of Japanese Patent No. 2000208492 A to Yamashita and U.S. Patent No. 5,748,434 to Rossman et al.

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5. Kimura discloses a plasma etching apparatus in Figure 1a substantially as claimed and comprising: a chuck (multi-part structure, 2 and 20) for retaining a substrate (3); and hardware (4) that includes oxygen therein such that oxygen is released when an etching operation is carried out. See abstract.

6. However, while Kimura does teach that the focal ring can be made to contain a predetermined amount of oxygen by approaches other than coating (see JPO online translation, paragraph 50), Kimura does not explicitly teach that the oxygen is impregnated in the material of the focus ring.

7. Yamashita discloses the use of a focus ring formed of a material than includes oxygen impregnated therein (i.e. existing in quartz) for the purpose of preventing the in-plane uniformity of a semiconductor wafer from being damaged (abstract).

8. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided a focus ring formed of a material that includes oxygen impregnated (existing therein) in Kimura in order to prevent the in-plane uniformity of a semiconductor wafer from being damaged as taught by Yamashita.

9. Kimura and Yamashita disclose the invention substantially as claimed and as described above.

10. However, Kimura and Yamashita fail to teach the hardware comprises a focus ring and at least a portion of said focus ring substantially continuously extends below a peripheral portion of said chuck.

11. Rossman et al. disclose the use of a two-part focus ring (shield) set comprising an upper focus ring and a lower focus ring, wherein at least a portion of the lower focus ring substantially continuously extends below a peripheral portion of the chuck and is disposed completely below the upper focus ring for the purpose of increasing the ratio of exposed surface to thermal mass of the upper focus ring during processing, thereby decreasing the deposition rate thereon. Further, by structuring the focus ring set as

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described above the clean rate of the upper shield member is increased, thereby enhancing the throughput of the process.

12. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided a two-part focus ring set comprising an upper focus ring and a lower focus ring wherein at least a portion of the lower focus ring substantially continuously extends below a peripheral portion of the chuck and is disposed completely below the upper focus ring in Kimura and Yamashita in order to increase the ratio of exposed thermal mass of the upper focus ring during processing thereby decreasing the deposition rate thereon and also in order to increase the clean rate of the upper shield thereby enhancing throughput of the process as taught by Rossman et al.

13. With respect to claim 2, said chuck is substantially circular (it is designed to correspond with the periphery of the chuck and wafer, which are both circular; see Figures 1b and 2b) and said hardware comprises a focus ring that peripherally surrounds said chuck (see Figure 1a).

14. With respect to claim 4, said chuck comprises an electrostatic chuck (see paragraph 25 of Kimura JPO online translation).

15. With respect to claims 5 and 6, said hardware comprises a focus ring formed of ceramic (e.g. quartz). The exact composition can be determined based on an intended method that will take place in the apparatus. See JPO online translation, paragraphs 6 and 50).

16. The limitations of claim 29 are similar to those of claim 1 and are addressed above.

17. With respect to claims 30 and 32, it would have been obvious to one of ordinary skill in the art to form a chuck (or any other part of the etching apparatus that may be exposed during processing) of an oxygenated material for the same purpose that the focus ring is taught to be formed of an oxygen-impregnated material. So that upon exposure, oxygen is discharged and the uniformity of an etch rate can be improved.

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18. With respect to claim 7, as described above, Rossman et al. disclose the use of focus ring set comprising an upper focus ring and a lower focus ring peripherally surrounding said chuck.

19. With respect to claim 31, said chuck of Kimura comprises an electrostatic chuck (see paragraph 25 of JPO online translation).

20. The limitations of claim 33 are addressed above.

21. Claims 3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent No. 2002009042 A to Kimura in view of U.S. Patent No. 5,748,434 to Rossman et al.

22. Regarding claim 8, Kimura discloses a plasma etching apparatus in Figure 1a substantially as claimed and comprising: a chuck (multi-part structure, 2 and 20) for retaining a substrate (3); and hardware (4) that includes oxygen therein such that oxygen is released when an etching operation is carried out. See abstract.

23. However, Kimura fails to teach the hardware comprises a focus ring and at least a portion of said focus ring substantially continuously extends below a peripheral portion of said chuck.

24. Rossman et al. disclose the use of a two-part focus ring (shield) set comprising an upper focus ring and a lower focus ring, wherein at least a portion of the lower focus ring substantially continuously extends below a peripheral portion of the chuck and is disposed completely below the upper focus ring for the purpose of increasing the ratio of exposed surface to thermal mass of the upper focus ring during processing, thereby decreasing the deposition rate thereon. Further, by structuring the focus ring set as described above the clean rate of the upper shield member is increased, thereby enhancing the throughput of the process.

25. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided a two-part focus ring set comprising an upper focus ring and a lower focus ring wherein at least a portion of the lower focus ring substantially continuously extends below a

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peripheral portion of the chuck and is disposed completely below the upper focus ring in Kimura in order to increase the ratio of exposed thermal mass of the upper focus ring during processing thereby decreasing the deposition rate thereon and also in order to increase the clean rate of the upper shield thereby enhancing throughput of the process as taught by Rossman et al.

26. With respect to claim 3, in Rossman et al. at least a portion of said lower focus ring substantially continuously extends below a peripheral portion of the chuck.

27. Claim 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura, Yamashita and Rossman et al. as applied to claims 1-2, 4-7 and 29-33 above, and further in view of Japanese Patent No. 2002016126 to Nagaiwa et al.

28. Kimura, Yamashita and Rossman et al. disclose the invention substantially as claimed and as described above.

29. However, Kimura, Yamashita and Rossman et al. fail to teach said focus ring is maintainable at a temperature not greater than a temperature of said substrate while and etching operation is carried out upon said substrate.

30. Nagaiwa et al. disclose a plasma etching apparatus in Figures 1 and 2 comprising: a focus ring (12); and a chuck (11) for retaining a substrate, said focus ring capable of being maintained at a temperature no greater than a temperature of said substrate while and etching operation is carried out for the purpose of preventing deteriorated etching characteristics due to the influence of temperature. Also see abstract and paragraphs 24 and 25 of JPO online translation.

31. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided said focus ring capable of being maintained at a temperature no greater than a temperature of said substrate while and etching operation is carried out in Kimura, Yamashita and

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Rossman et al. in order to prevent deteriorated etching characteristics due to the influence of temperature as taught by Nagaiwa et al.

32. Additionally, with respect to claim 10, Kimura et al. disclose that the substrate may be a semiconductor substrate (paragraph 1 of JPO online translation). Naigawa teaches this also.

33. With regards to claim 11, Naigawa further teaches that said focus ring maintains contact with the said electrostatic chuck and said chuck is cooled during said etching operation, as described above and illustrated in Figures 1 and 2.

34. With respect to claim 12, said focus ring is disposed peripherally around said substrate and includes a portion that rests on an annular landing section of the chuck in Kimura and Rossman et al.

35. Claim 33 is are rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent No. 2002009042 A to Kimura in view of Japanese Patent No. 2000208492 A to Yamashita, U.S. Patent No. 5,748,434 to Rossman et al. and Japanese Patent No. 2002016126 to Nagaiwa et al.

36. Kimura discloses a plasma etching apparatus in Figure 1a substantially as claimed and comprising: a chuck (multi-part structure, 2 and 20) for retaining a substrate (3); and hardware (4) that includes oxygen therein such that oxygen is released when an etching operation is carried out. See abstract.

37. However, while Kimura does teach that the focal ring can be made to contain a predetermined amount of oxygen by approaches other than coating (see JPO online translation, paragraph 50), Kimura does not explicitly teach that the oxygen is impregnated in the material of the focus ring.

38. Yamashita discloses the use of a focus ring formed of a material than includes oxygen impregnated therein (i.e. existing in quartz) for the purpose of preventing the in-plane uniformity of a semiconductor wafer from being damaged (abstract).

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39. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided a focus ring formed of a material that includes oxygen impregnated (existing therein) in Kimura in order to prevent the in-plane uniformity of a semiconductor wafer from being damaged as taught by Yamashita.

40. Kimura and Yamashita disclose the invention substantially as claimed and as described above.

41. However, Kimura and Yamashita fail to teach the hardware comprises a focus ring and at least a portion of said focus ring substantially continuously extends below a peripheral portion of said chuck.

42. Rossman et al. disclose the use of a two-part focus ring (shield) set comprising an upper focus ring and a lower focus ring, wherein at least a portion of the lower focus ring substantially continuously extends below a peripheral portion of the chuck and is disposed completely below the upper focus ring for the purpose of increasing the ratio of exposed surface to thermal mass of the upper focus ring during processing, thereby decreasing the deposition rate thereon. Further, by structuring the focus ring set as described above the clean rate of the upper shield member is increased, thereby enhancing the throughput of the process.

43. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided a two-part focus ring set comprising an upper focus ring and a lower focus ring wherein at least a portion of the lower focus ring substantially continuously extends below a peripheral portion of the chuck and is disposed completely below the upper focus ring in Kimura and Yamashita in order to increase the ratio of exposed thermal mass of the upper focus ring during processing thereby decreasing the deposition rate thereon and also in order to increase the clean rate of the upper shield thereby enhancing throughput of the process as taught by Rossman et al.

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44. Kimura, Yamashita and Rossman et al. disclose the invention substantially as claimed and as described above.

45. However, Kimura and Yamashita fail to teach said focus ring is maintainable at a temperature not greater than a temperature of said substrate while and etching operation is carried out upon said substrate.

46. Nagaiwa et al. disclose a plasma etching apparatus in Figures 1 and 2 comprising: a focus ring (12); and a chuck (11) for retaining a substrate, said focus ring capable of being maintained at a temperature no greater than a temperature of said substrate while and etching operation is carried out for the purpose of preventing deteriorated etching characteristics due to the influence of temperature. Also see abstract and paragraphs 24 and 25 of JPO online translation.

47. It would have been obvious to one of ordinary skill in the art at the time the Applicant's invention was made to have provided said focus ring capable of being maintained at a temperature no greater than a temperature of said substrate while and etching operation is carried out in Kimura, Yamashita and Rossman et al. in order to prevent deteriorated etching characteristics due to the influence of temperature as taught by Nagaiwa et al.

Response to Arguments

48. Applicant's arguments with respect to claims 1-12 and 29-33 have been considered but are moot in view of the new ground(s) of rejection and/or the comments below. New art is relied upon that a two-part focus ring set comprising an upper focus ring and a lower focus ring wherein at least a portion of the lower focus ring substantially continuously extends below a peripheral portion of the chuck and is disposed completely below the upper focus ring.

49. Applicant's other argument drawn to the purported non-obviousness of forming the chuck itself of an oxygen-impregnated material is not persuasive. The chuck is a part of the plasma etching apparatus and therefore has influence over the conditions of the system in which it is contained. Yamashita teaches

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that the oxygen impregnated construction material is provided so that a processing part exposed to reaction products has the ability to convert the reaction products to quickly-evaporated, volatile substances, which prevents damage to a wafer being processed. Such a material would also be beneficial in constructing a chuck in that a chuck is also exposed to the same reaction products and the same wafer being processed.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karla Moore whose telephone number is 571.272.1440. The examiner can normally be reached on Monday-Friday, 9:00 am-6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571.272.1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Karla Moore
Primary Examiner
Art Unit 1763
8 January 2007